

Scope of Claim

[1] An automatic zero point correction device for a pressure sensor characterize by being so constituted that, with a pressure sensor to measure fluid pressure, the output voltage from the pressure sensor is outputted to the outside, the afore-mentioned sensor output voltage is inputted to the time-varying zero point drift correction means of the pressure sensor, a judgment is made to determine if the afore-mentioned sensor output voltage is larger than the set value with the said sensor output judgment means of the time-varying zero point drift correction means, and further the operating conditions of the pressure sensor are judged with the afore-mentioned operating condition judgment means of the time-varying zero point drift correction means, the time-varying zero point drift of the pressure sensor is cancelled when it is found that the afore-mentioned sensor output voltage is larger than the set value and the operating conditions of the pressure sensor are under the operating conditions previously set.

[2] An automatic zero point correction device for a pressure sensor as claimed in Claim 1 wherewith it is so constituted that a semiconductor pressure sensitive element is employed for a pressure sensor, the output voltage from the pressure sensor is outputted to the outside through the amplifier and is inputted to the time-varying zero point drift correction means of the pressure sensor through an A/D converter, and further the output for the zero point correction, which is identical to the afore-mentioned sensor output voltage and with reversed polarity, is inputted to the offset terminal of the afore-mentioned amplifier from the

afore-mentioned time-varying zero point drift correction means through the D/A converter when the sensor output voltage is larger than the set value and the pressure sensor is under the set operating conditions.

[3] An automatic zero point correction device for a pressure control device characterized by being so constituted that, with the pressure control device equipped with a control valve for pressure control and a pressure sensor to measure fluid pressure, the output voltage from the pressure sensor is outputted to the outside, the afore-mentioned sensor output voltage is inputted to the time-varying zero point drift correction means of the pressure sensor, a judgment is made to determine if the afore-mentioned sensor output voltage is larger than the set value with the said sensor output judgment means of the time-varying zero point drift correction means, and further the operating conditions of the pressure sensor are judged with the afore-mentioned operating condition judgment means of the time-varying zero point correction means, the time-varying zero point drift of the pressure sensor is cancelled when it is found that the afore-mentioned sensor output voltage is larger than the set value and the operating conditions of the pressure sensor are under the operating conditions previously set.

[4] An automatic zero point correction device for a pressure control device as claimed in Claim 3 wherein it is so constituted that a semiconductor pressure sensitive element is employed for a pressure sensor, the output voltage from the pressure sensor is outputted to the outside through the amplifier and is inputted to the time-varying zero point drift correction means of the pressure sensor through an A/D converter, and further the output for the zero point correction,

which is identical to the afore-mentioned sensor output voltage and with reversed polarity, is inputted to the offset terminal of the afore-mentioned amplifier from the afore-mentioned time-varying zero point drift correction means through the D/A converter when the sensor output voltage is larger than the set value and the pressure sensor is under the set operating conditions.

[5] An automatic zero point correction device for the pressure type flow rate control device characterized by being so constituted that, with the pressure type flow rate control device comprising an orifice for the flow rate control, a control valve mounted on the upstream side pipe from the orifice, and an upstream side pressure sensor installed between the orifice and the control valve to detect upstream side pressure P_1 to control the flow rate of fluid passing through the orifice by the upstream side pressure P_1 , the afore-mentioned output voltage from the pressure sensor is outputted to the flow rate computing means, the afore-mentioned sensor output voltage is inputted to the time-varying zero point drift correction means of the pressure sensor, a judgment is made to determine if the afore-mentioned sensor output voltage is larger than the set value with the said sensor output judgment means of the time-varying zero point drift correction means, and further the operating conditions of the pressure sensor are judged with the afore-mentioned operating condition judgment means of the time-varying zero point correction means, the time-varying zero point drift of the pressure sensor is cancelled when it is found that the afore-mentioned sensor output voltage is larger than the set value and the operating conditions of the pressure sensor are under the operating conditions previously set.

[6] An automatic zero point correction device for a pressure type flow rate

control device as claimed in Claim 5 wherein it is so constituted that a semiconductor pressure sensitive element is employed for a pressure sensor, the output voltage from the pressure sensor is outputted to the outside through the amplifier and inputted to the time-varying zero point drift correction means of the pressure sensor through an A/D converter, and further the output for the zero point correction, which is identical to the afore-mentioned sensor output voltage and with reversed polarity, is inputted to the offset terminal of the afore-mentioned amplifier from the afore-mentioned time-varying zero point drift correction means through the D/A converter when the sensor output voltage is larger than the set value and the pressure sensor is under the set operating conditions.

[7] An automatic zero point correction device for a pressure type flow rate control device characterized by being so constituted that, with the pressure type flow rate control device comprising an orifice for the flow rate control, a control valve mounted on the upstream side pipe from the orifice, an upstream side pressure sensor installed between the orifice and the control valve to detect upstream side pressure P_1 , and a downstream side pressure sensor mounted on the downstream side pipe to detect downstream side pressure P_2 to control the flow rate of fluid passing through the orifice by both upstream side pressure P_1 and downstream side pressure P_2 , the output voltage from the pressure sensor is outputted to the flow rate computing means, the afore-mentioned sensor output voltage is inputted to the time-varying zero point drift correction means of the pressure sensor, a judgment is made to determine if the afore-mentioned sensor output voltage is larger than the set value with the said sensor output

judgment means of the time-varying zero point drift correction means, and further the operating conditions of the pressure sensor are judged with the afore-mentioned operating condition judgment means, the time-varying zero point drift of the pressure sensor is cancelled when it is found that the afore-mentioned sensor output voltage is larger than the set value and the operating conditions of the pressure sensor are under the operating condition previously set.

[8] An automatic zero point correction device for a pressure type flow rate control device as claimed in Claim 7 wherein it is so constituted that a semiconductor pressure sensitive element is employed for a pressure sensor, the output voltage from the pressure sensor is outputted to the outside through the amplifier and is inputted to the time-varying zero point drift correction means of the pressure sensor through an A/D converter, and further the output for the zero point correction, which is identical to the afore-mentioned sensor output voltage and with reversed polarity, is inputted to the offset terminal of the afore-mentioned amplifier from the afore-mentioned time-varying zero point drift correction means through the D/A converter when the sensor output voltage is larger than the set value and the pressure sensor is under the set operating conditions.

[9] An automatic zero point correction device for a pressure control device as claimed in Claim 3 or Claim 4 wherein the set value as a reference at the sensor output judgment means of the time-varying zero point drift correction means of the pressure sensor becomes the sensor output voltage equivalent to less than control accuracy of the full scale pressure to be detected by the pressure sensor.

[10] An automatic zero point correction device for a pressure control device as claimed in Claim 3 or Claim 4 wherein it is so made that the set operating conditions as a reference at the operating condition judgment means of the time-varying zero point drift correction means of the pressure sensor are made up of three conditions, that is, whether or not a signal for forced opening to the control valve exists, whether or not a signal for forced closing to the control valve exists, and the set signal for the flow rate is zero.

[11] An automatic zero point correction means for the pressure type flow rate control device as claimed in Claim 5, Claim 6, Claim 8 or Claim 9 wherein it is so made that the set value as a reference at the sensor output judgment means of the time-varying zero point drift correction means of the pressure sensor becomes the sensor output voltage equivalent to less than control accuracy of the full scale pressure to be detected by the pressure sensor.

[12] An automatic zero point correction means for the pressure type flow rate control device as claimed in Claim 5, Claim 6, Claim 8 or Claim 9 wherein it is so made that the set operating conditions as a reference at the operating condition judgment means of the pressure sensor are made up of three conditions, that is, whether or not a signal to forced opening to the control valve exists, whether or not a signal to forced closing to the control valve exists, and the set value of the flow rate is zero.

[13] An automatic zero point correction means for a pressure control device as claimed in Claim 4 wherein it is so made that a D/A converter, through which voltage for the zero point correction is outputted to the offset terminal of the amplifier from the time-varying zero point correction means, is shared with the

temperature drift correction means of the pressure sensor mounted on the flow rate computing means of the said pressure type flow rate control device.

[14] An automatic zero point correction means for the pressure type flow rate control device as claimed in Claim 6 or Claim 8 wherein it is so constituted that a D/A converter, through which voltage for the zero point correction is outputted to the offset terminal of the amplifier from the time-varying zero point drift correction means, is shared with the temperature drift correction means of the pressure sensor mounted on the flow rate computing means of the said pressure type flow rate control device.

Summary

The present invention is to provide a pressure sensor to make it possible to detect pressure accurately regardless of its service period by automatically correcting the time-varying zero drift of the pressure sensor, and also a pressure control device and a flow rate control device wherein the pressure sensor is employed.

Concretely, with the pressure sensor, for which a semiconductor pressure sensitive element is used, to measure fluid pressure, the output voltage from the pressure sensor is outputted to the outside through the amplifier, the afore-mentioned sensor output voltage is inputted to the time-varying zero point drift correction means through the D/A converter, a judgment is made to determine if the afore-mentioned sensor output voltage is larger than the set value at the sensor output judgment means of the said time-varying zero point drift correction means, and further the operating conditions of the pressure sensor are judged at the operating condition judgment means of the afore-mentioned time-varying zero point drift correction means, and the time-varying zero point drift of the pressure sensor is cancelled by inputting the voltage for the zero point correction, which is identical to the afore-mentioned sensor output voltage and with reversed polarity, to the offset terminal of the afore-mentioned amplifier through the D/A converter when it is found that the afore-mentioned sensor output voltage is larger than the set value and the operating conditions of the pressure sensor are under the operating conditions previously set.

[Figure 3]

Zero point stabilization time maintained under vacuum (after leaving under atmospheric pressure for 24 hours)

PT output (mV)

Measurement time (hour)

[Figure 4]

PT output changes

25 hours 25 hours 29 hours

Measurement time (hour)

[Figure 5]

Zero point change volume for 5 hours at the 0-60Torr cycle test

Zero point change volume (%F.S.)

Test specimen ①, Test specimen ②, Test specimen ③, Test specimen ④,

Test specimen⑤

Cycle time (days)

[Figure 6]

Zero point change volume for 5 hours at the vacuum \leftrightarrow 0.1MPaG cycle test

Zero point change volume

Test period (days)

[Figure 7]

Zero point change volume fro 5 hours at the 0.1Mpa maintaining test

Zero point change volume (%F.S.)

Test period (days)

[Figure 11]

- 3 Pressure sensor
- 4 Temperature sensor (thermistor)
- Qc Output signal
- Qs Input signal
- 7, 7a' Flow rate linearity correction
- 7c Comparative computation
- 16 Fixed amplification circuit
- 17 Variable amplification circuit
- 18 Variable amplification circuit
- 19 A/D converter
- 40 D/A converter
- 41 D/A converter
- 42 A/D converter
- 43 A/D converter
- 44 A/D converter
- 45 Fixed amplification circuit
- 46 Fixed amplification circuit
- 47 Fixed amplification circuit
- 48 Pressure sensor temperature drift correction
- 50 Piezo-step-up circuit